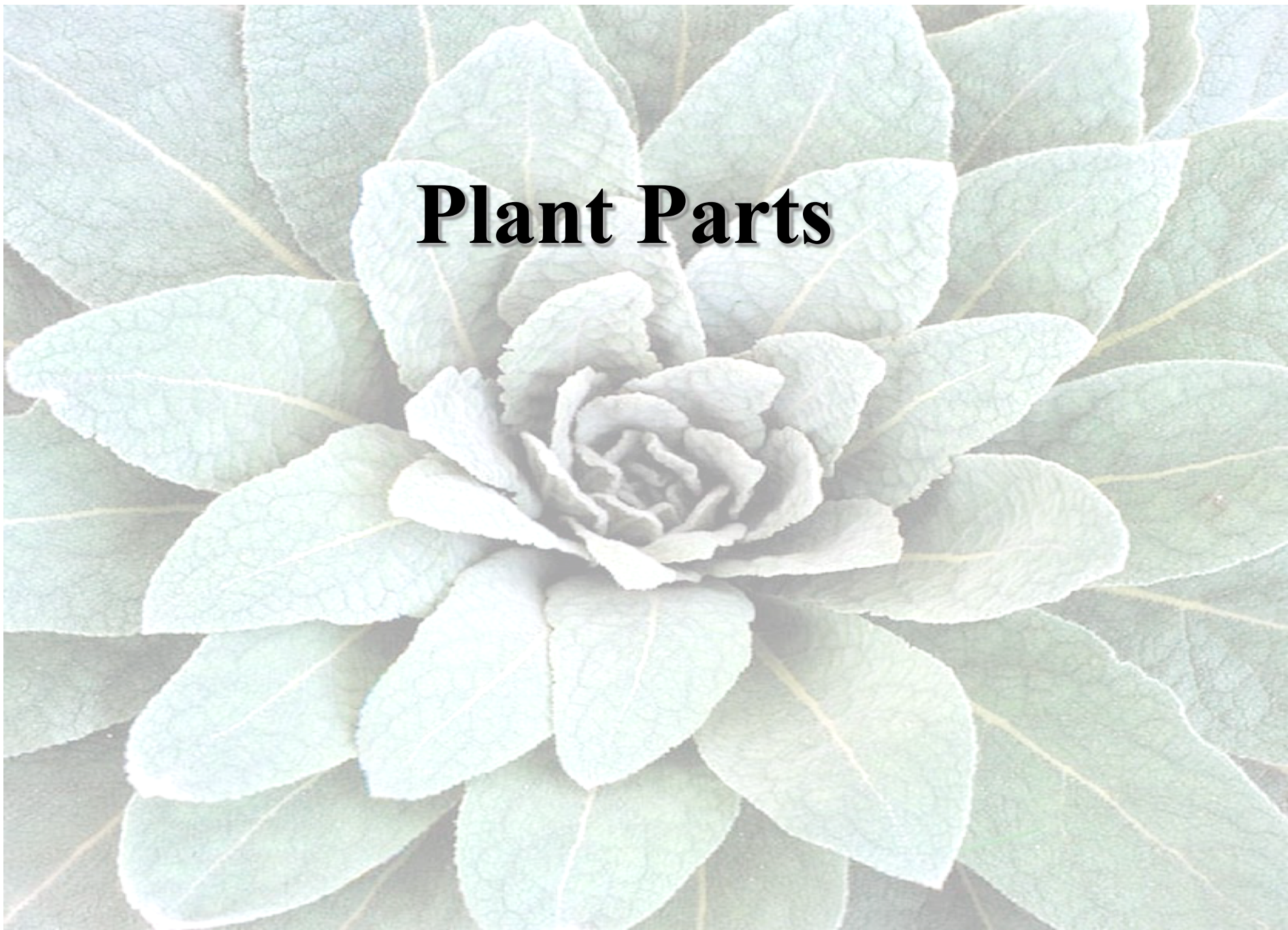


Plant Parts

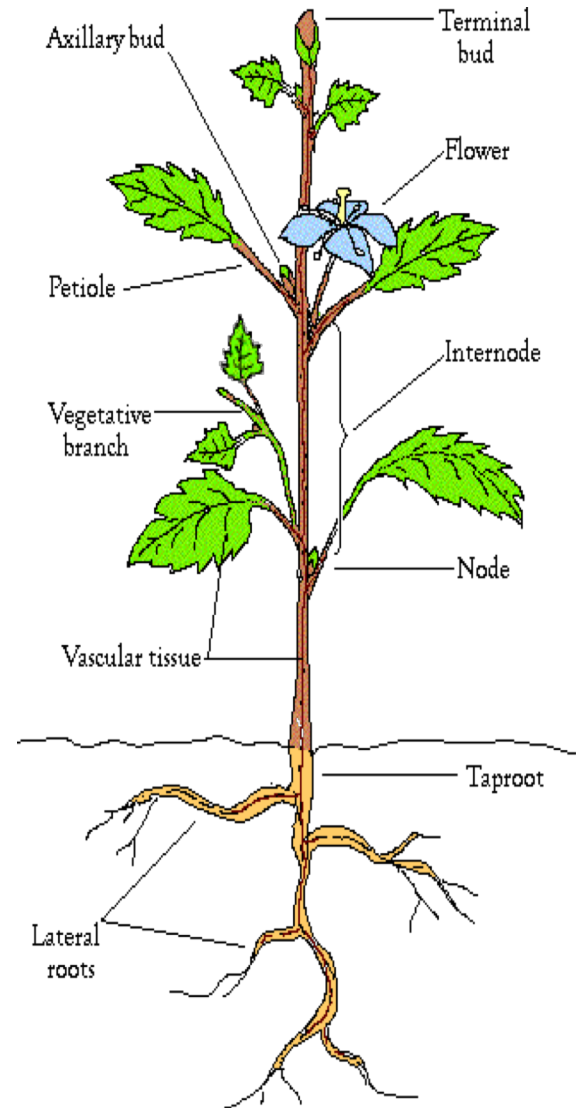


- Plant Anatomy

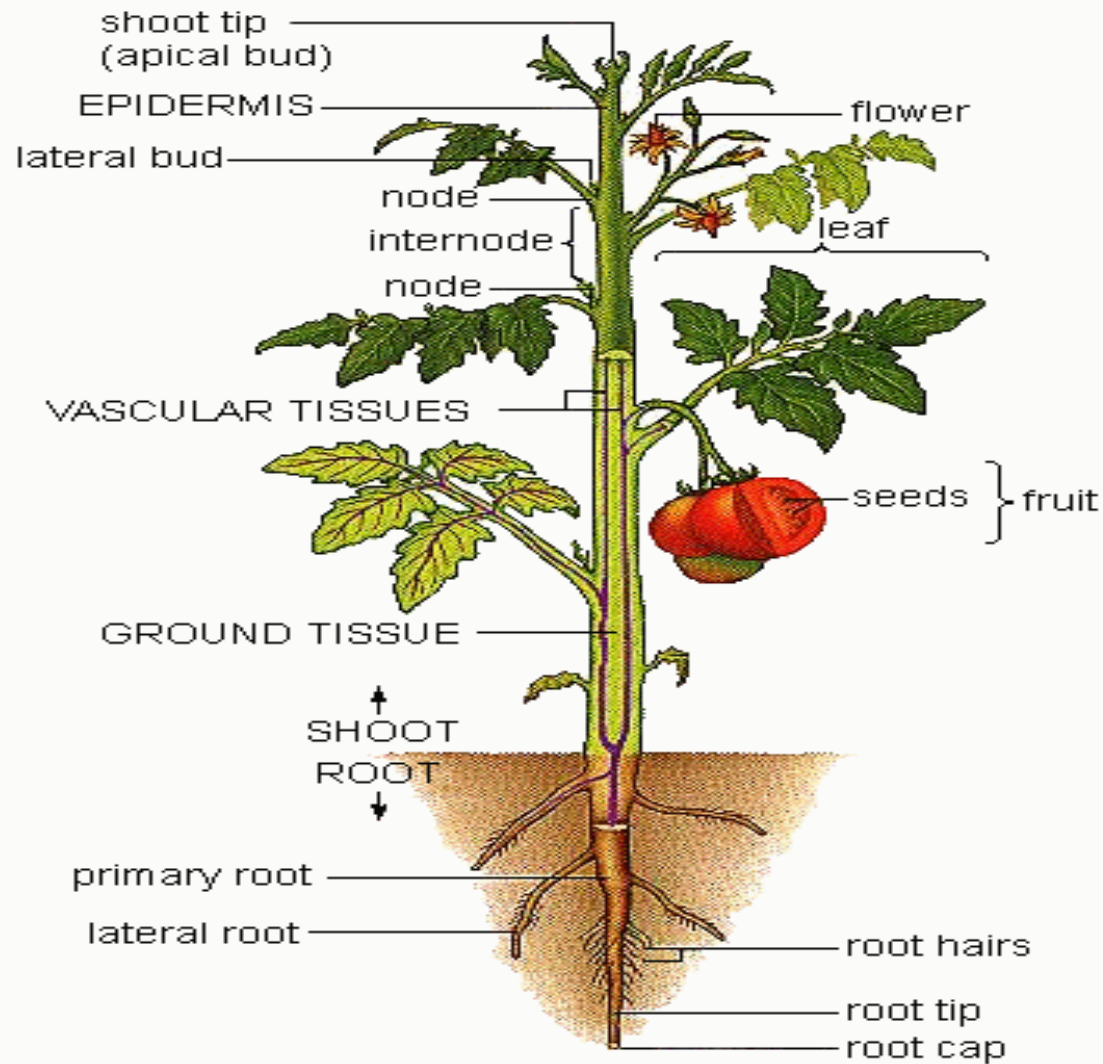
- Cells
- Tissues
- Organs

- Plant Physiology

- Water & sugar transport
- Plant hormones



The Plant Parts



What is plant Morphology ?

MORPHOLOGY: Study of form

What is plant anatomy?

ANATOMY: study of the **structure** of organisms... looking at cells, tissues

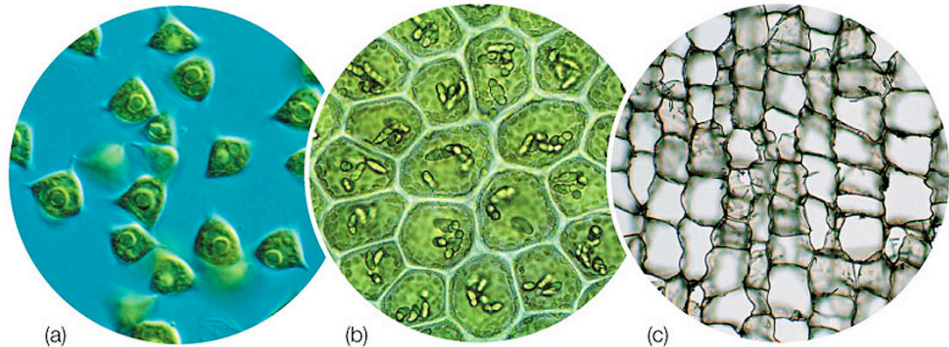
What is plant physiology ?

- **PHYSIOLOGY**: study of the **function** of cells, tissues, organs of living things; and the physics/chemistry of these functions...

Plant Anatomy: Cells

- Plant cells are basic building blocks
- Can specialize in form and function
- By working together, forming tissues, they can support each other and survive
- Levels of organization

atoms > molecules > cells > tissues > organs > whole plant > pop.

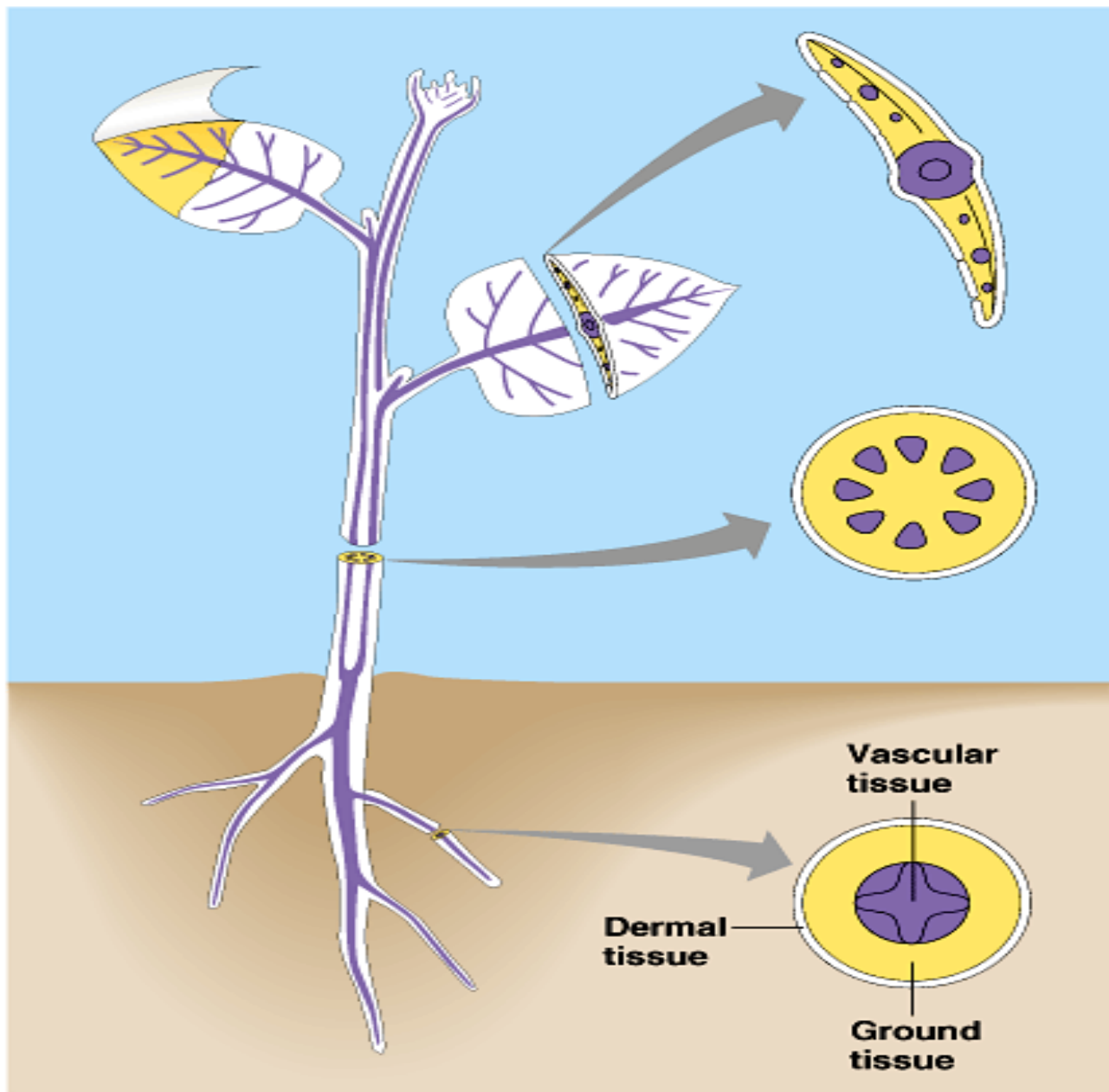


Plant Tissues Types

All plant organs (roots, stems, leaves) are composed of the same tissue types.

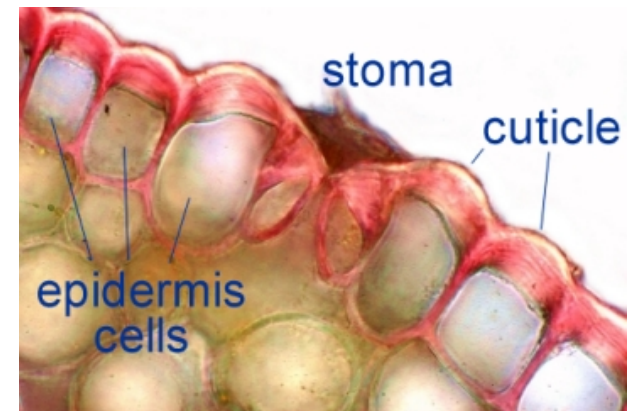
There are three types of tissue:

- **1. Dermal** – outermost layer
- **2. Vascular** – conducting tissue, transport
- **3. Ground** – bulk of inner layers



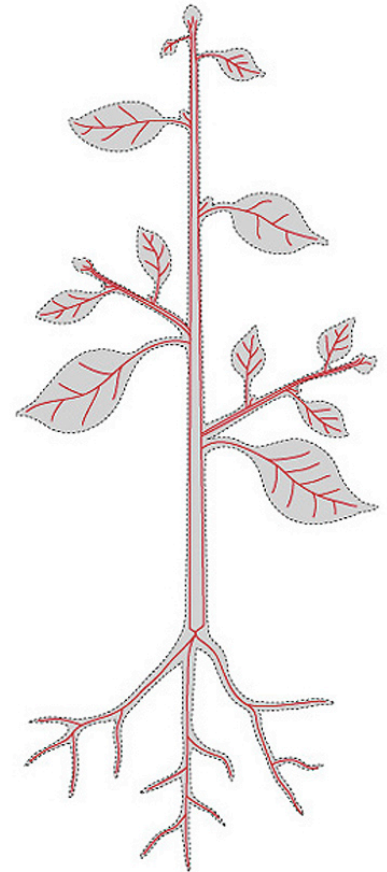
1. Dermal tissue

- **Epidermis** is the outermost layer of cells
- Like the “skin” of animals
- In stems and leaves, epidermis has **cuticle**, a waxy layer that prevents water loss.
- Some have **trichomes**, hairs.
- Root epidermis has **root hairs**, for water and nutrient absorption



2. Vascular tissue

- Transports water and organic materials (sugars) throughout the plant
- **Xylem** – transports water and dissolved ions from the root to the stem and leaves.
- **Phloem** – carries dissolved sugars from leaves to rest of the plant

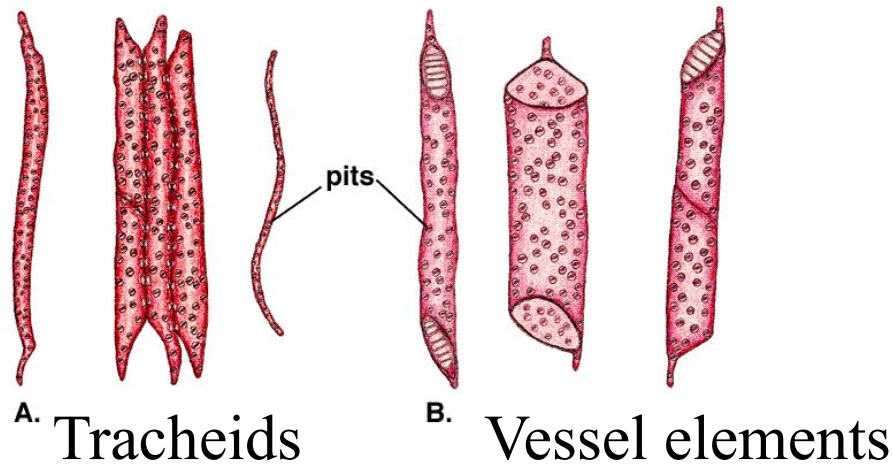


Xylem

- Transports water and dissolved minerals
- **Tracheids**: long, thin tube like structures without perforations at the ends
- **Vessel elements**: short, wide tubes perforated at the ends (together form a pipe, called vessel).
- Both cells have **pits** (thin sections) on the walls

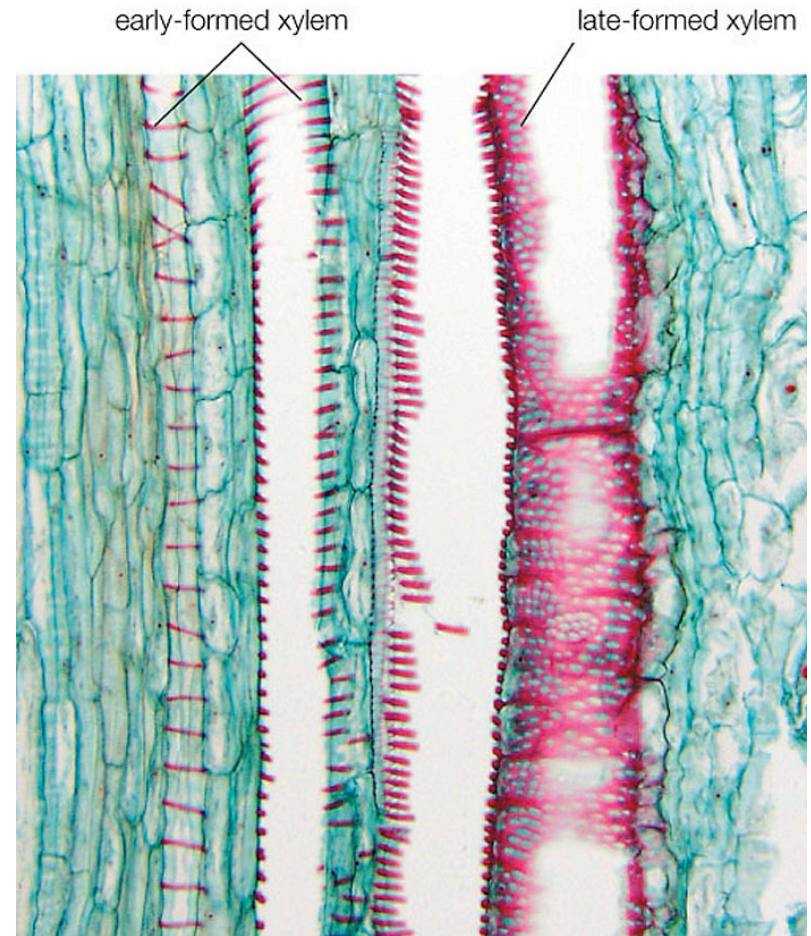
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Water-conducting Cells of Xylem



Xylem cells

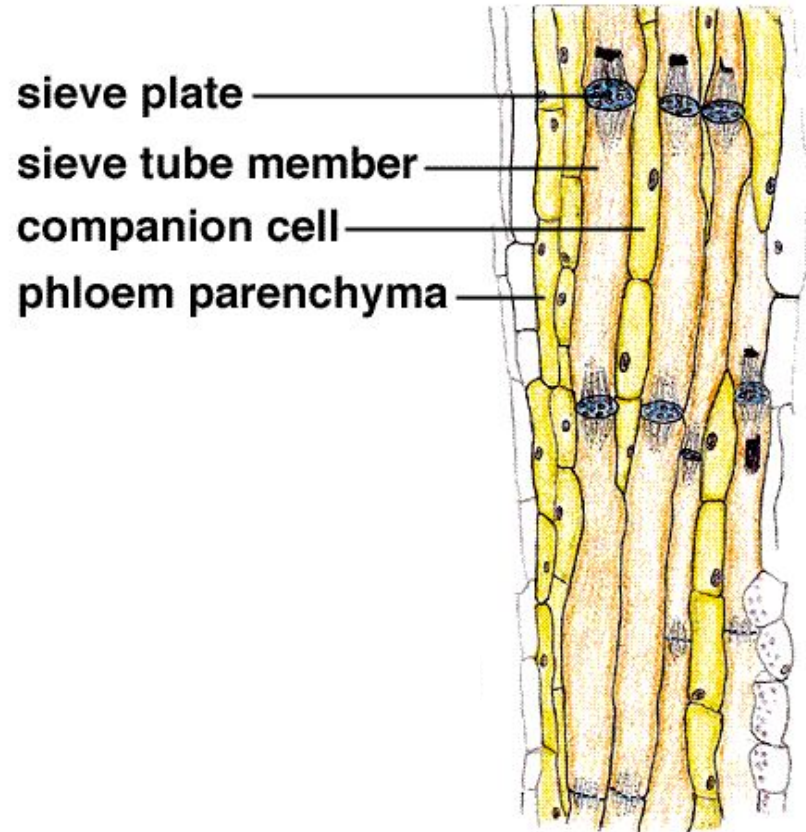
- **Xylem** cells are dead!
- They are hollow cells and consist only of cell wall



Phloem

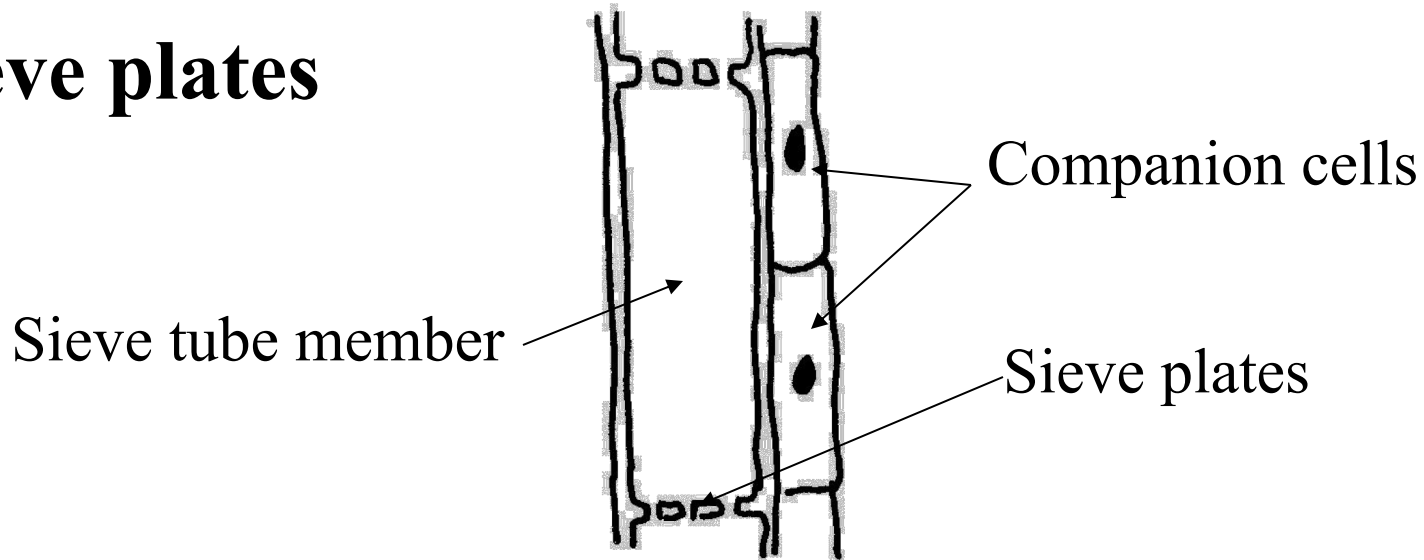
- Cells that transport organic materials (sugars)
- Phloem cells are **ALIVE!** (unlike xylem)
- However, they lack nucleus and organelles

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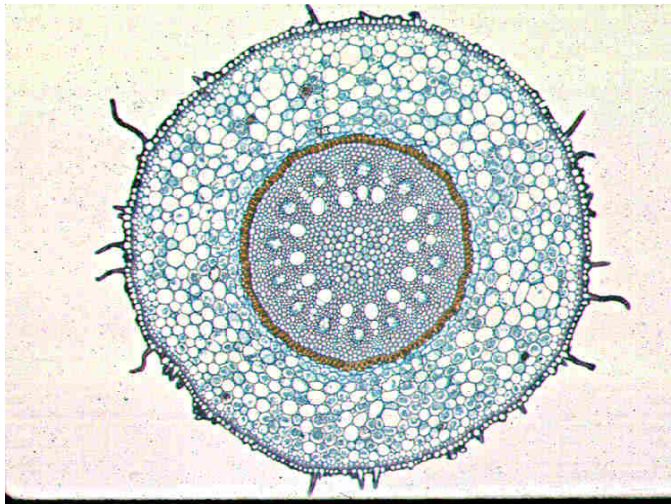
Phloem: transports sugars

- Phloem composed of cells called **sieve tube members (STM)**
- **Companion cells** join sieve tube members, are related, and help to load materials into STM
- End walls of STM have large pores called **sieve plates**

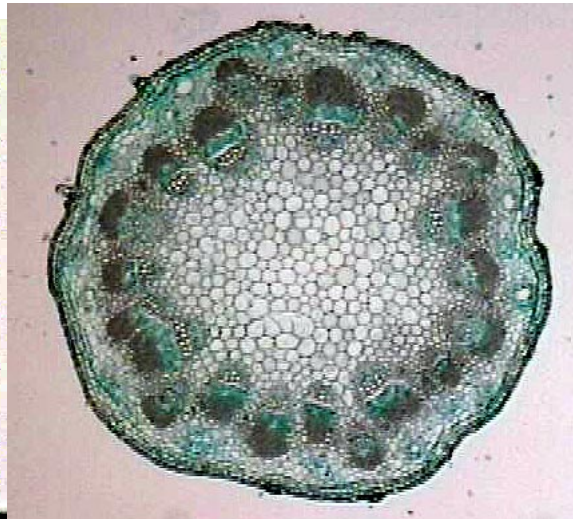


3. Ground tissue

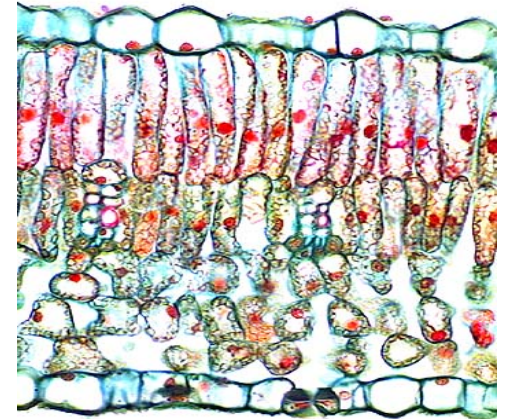
- Makes up the bulk of plant organs.
- Functions: Metabolism, storage and support.



Root



Stem

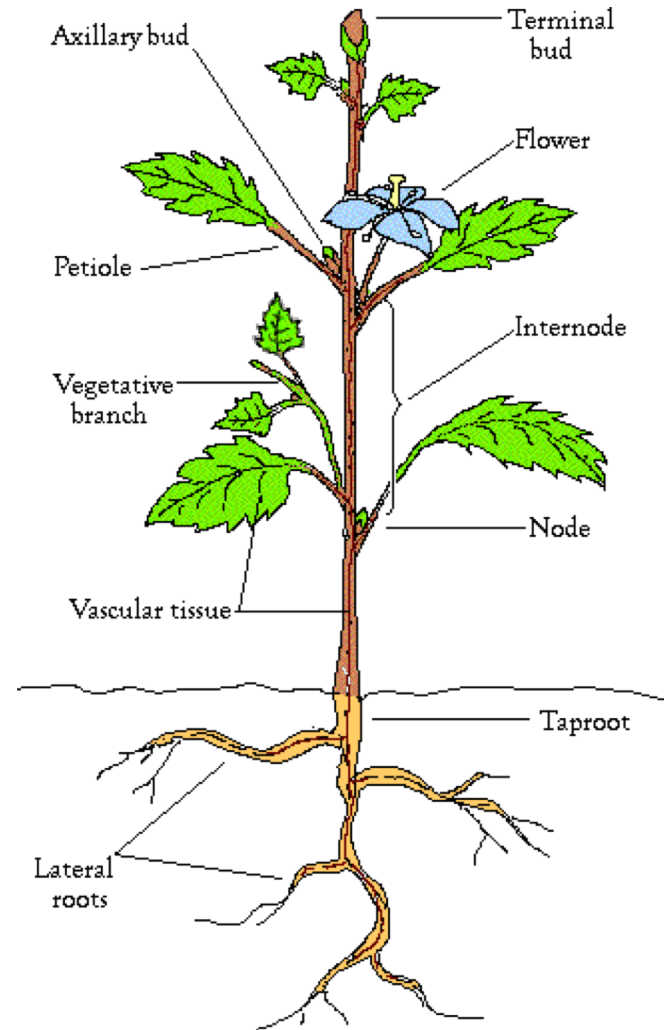


Leaf

Plant Organs

Organs: tissues that act together to serve a specific function

- **Roots** { Dermal
Vascular
Ground
- **Stems** { Dermal
Vascular
Ground
- **Leaves** { Dermal
Vascular
Ground

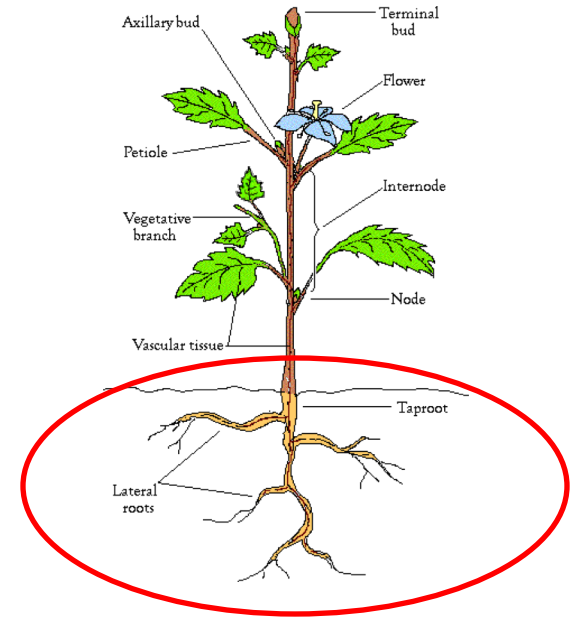


Functions of plant organs:

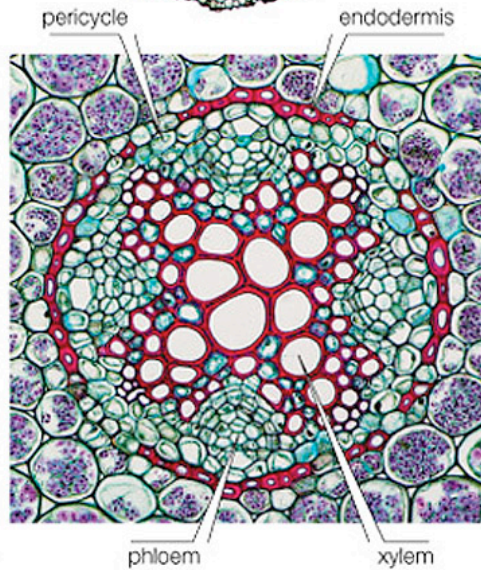
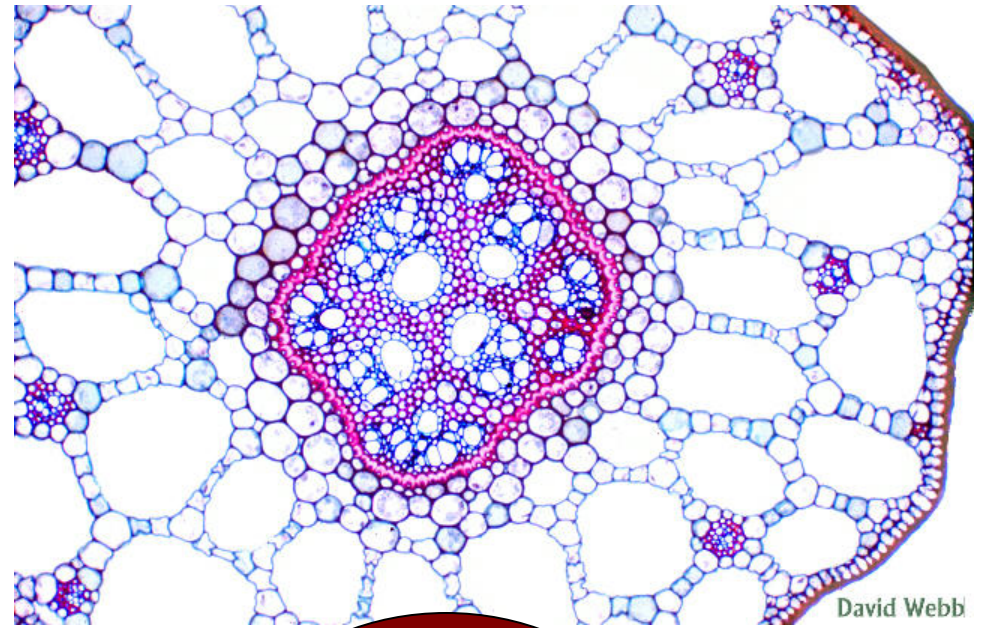
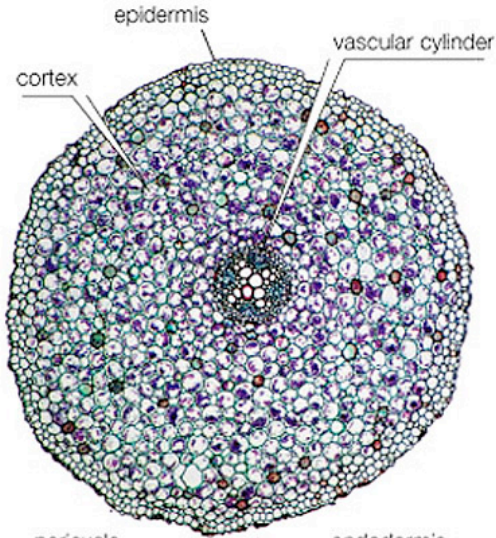
- ROOTS: Anchorage, water/nutrient absorption from soil, storage, water/nutrient transport
- STEMS: Support, water/nutrient transport
- LEAVES: Photosynthesis (food production)

ROOTS

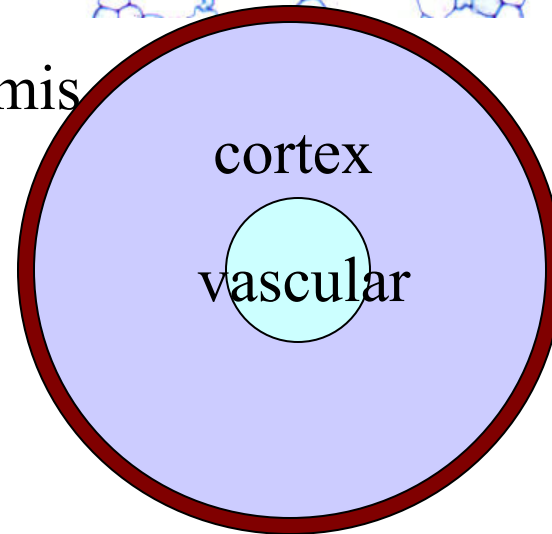
- **ROOTS** “the hidden half”
- Functions of roots:
- Ancorage
- Absorption of water & dissolved minerals
- Storage (surplus sugars, starch)
- Conduction water/nutrients



Anatomy of a root

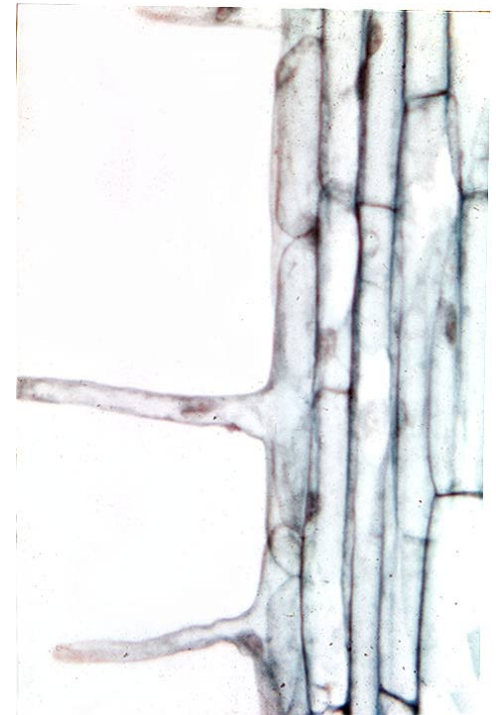
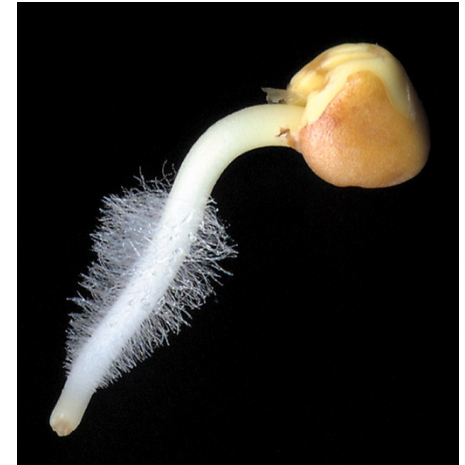


epidermis

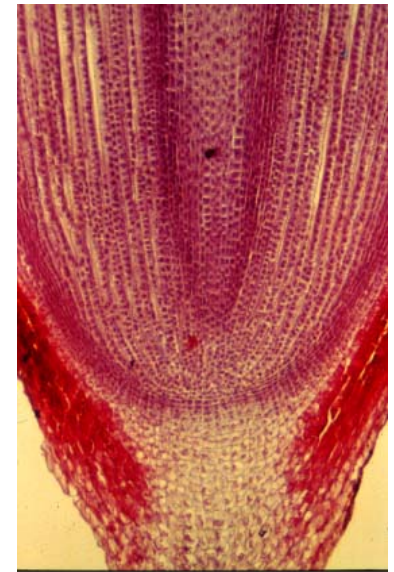
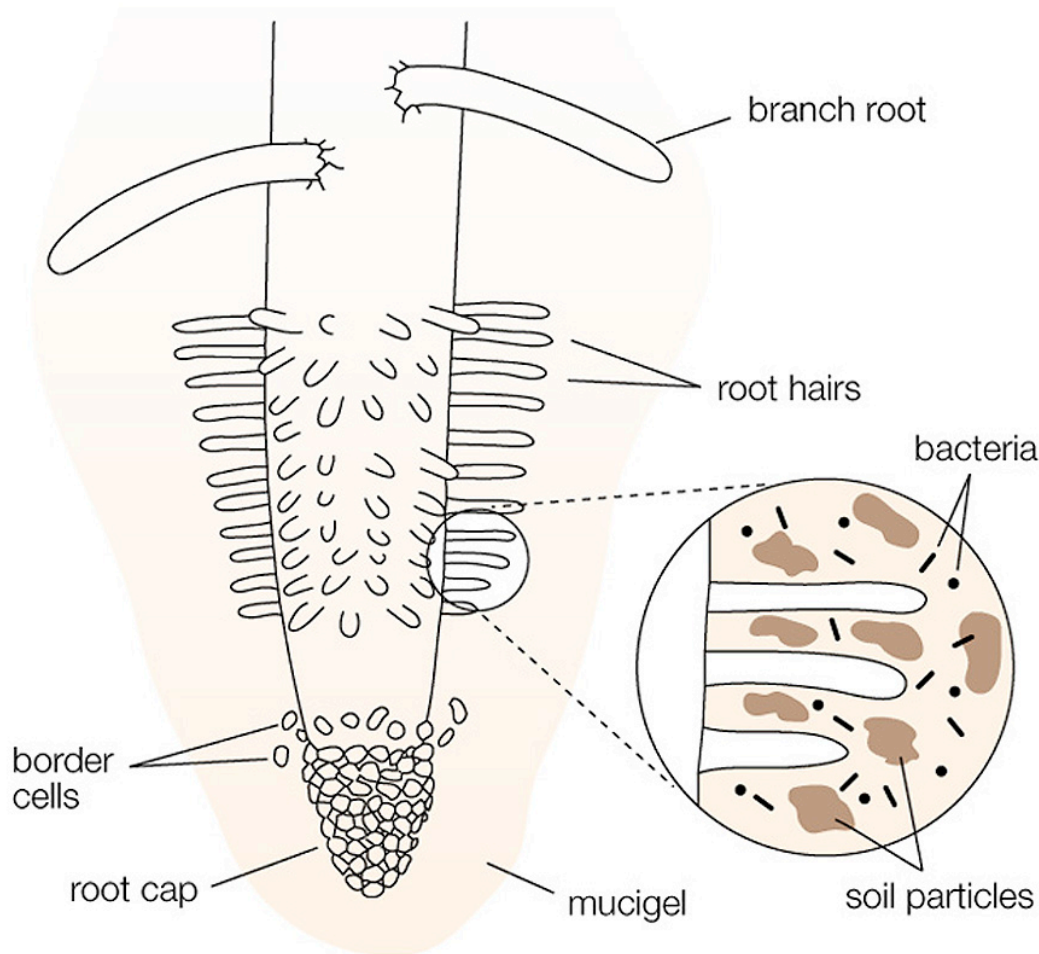


Root Epidermis

- Outermost, single layer of cells that:
 - Protects (from diseases)
 - Absorbs water and nutrients
- **ROOT HAIRS:** tubular extensions of epidermal cells.
- Increase surface area of root, for better water/nutrient absorption



Root Hairs: water and mineral absorption

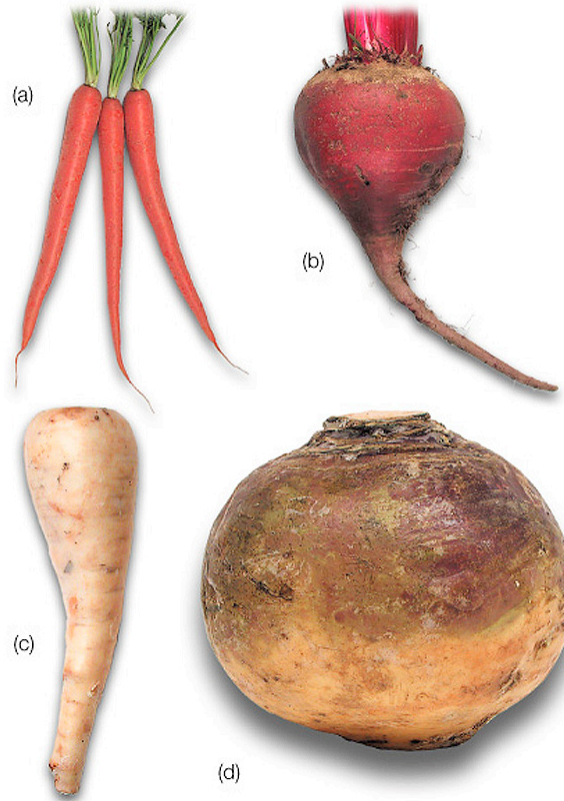


Root tip - cap & apical meristem

Root hairs increase surface area for better absorption

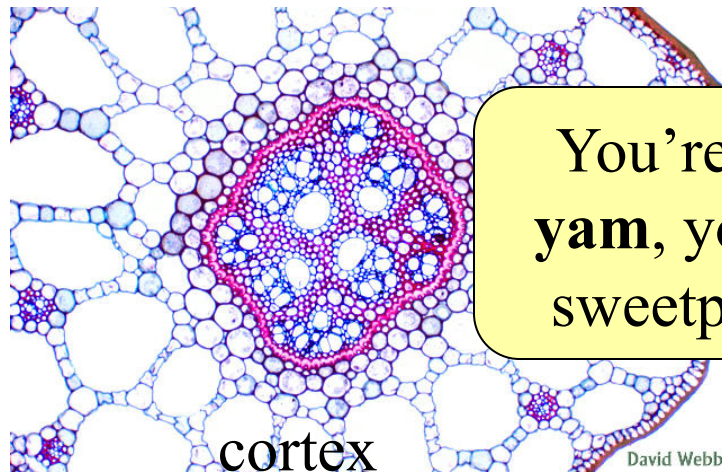
Root Cortex

- Stores starch, sugars and other substances



Root Ground tissue

- In roots, ground tissue (a.k.a. cortex) provides support, and often stores sugars and starch (for example: yams, sweet potato, etc.)



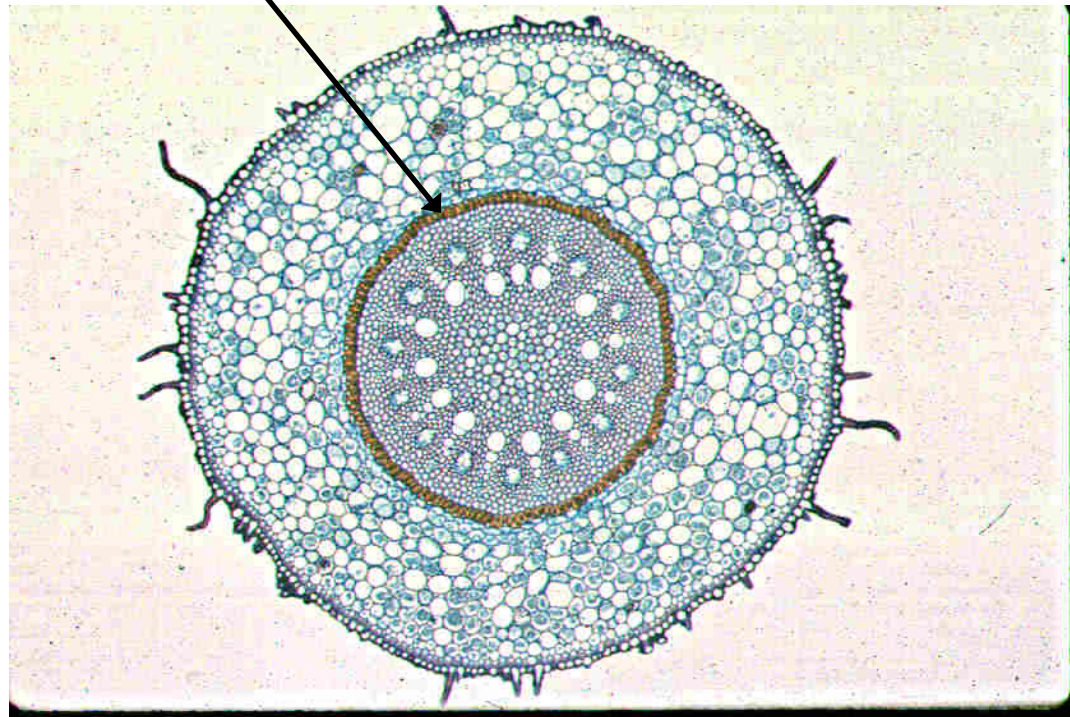
You're not a **yam**, you're a sweetpotato!



Hey!
I **yam**
what I
yam,
man!

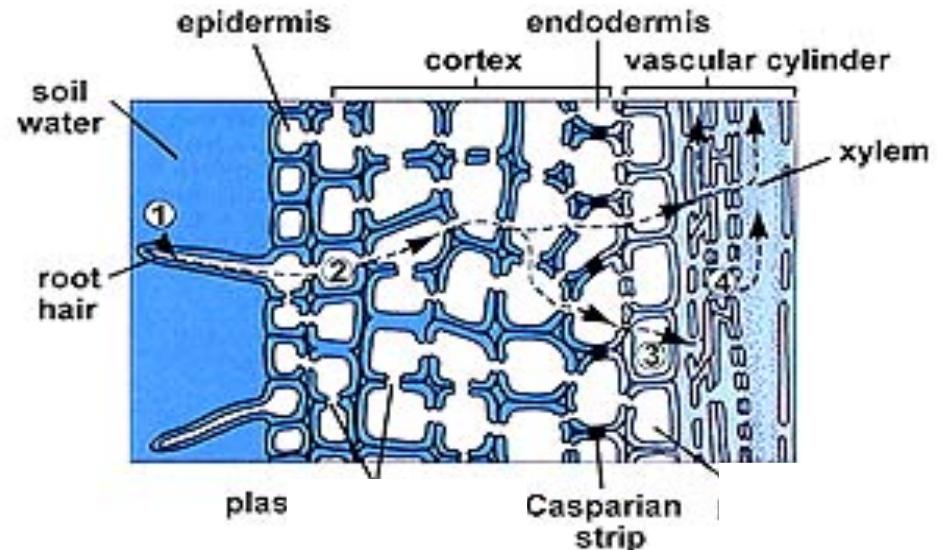
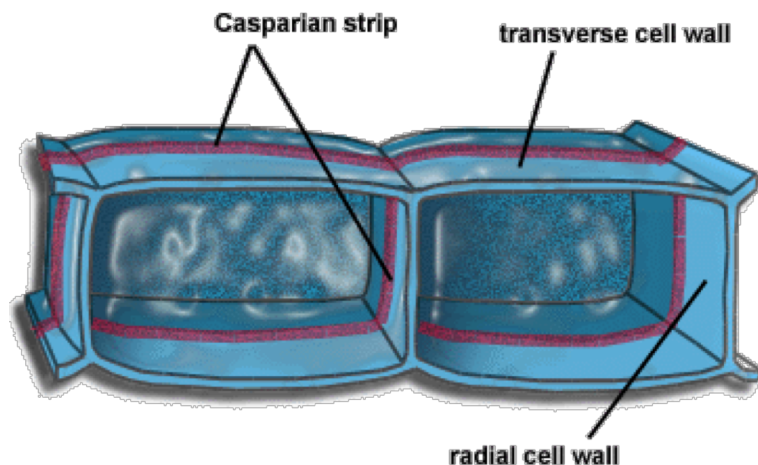
Root Cortex: Endodermis

- **Endodermis:** the innermost layer of the cortex



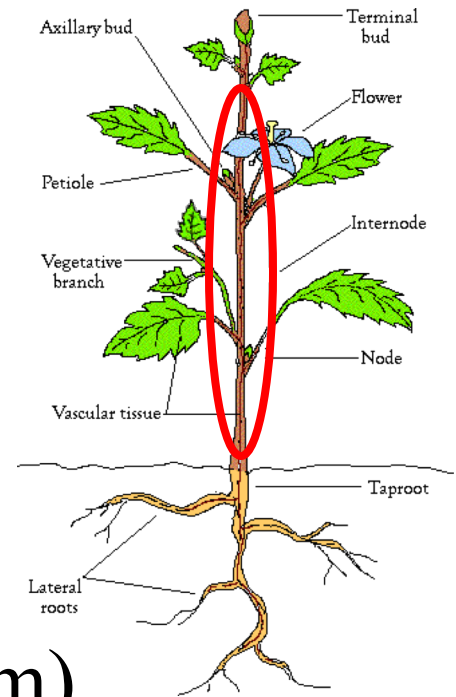
Root cortex: Casparian strip

- The **Casparian strip** is a water-impermeable strip of waxy material found in the **endodermis** (innermost layer of the cortex).
- The **Casparian strip** helps to control the uptake of minerals into the xylem: they have to go through the cytoplasm of the cell!



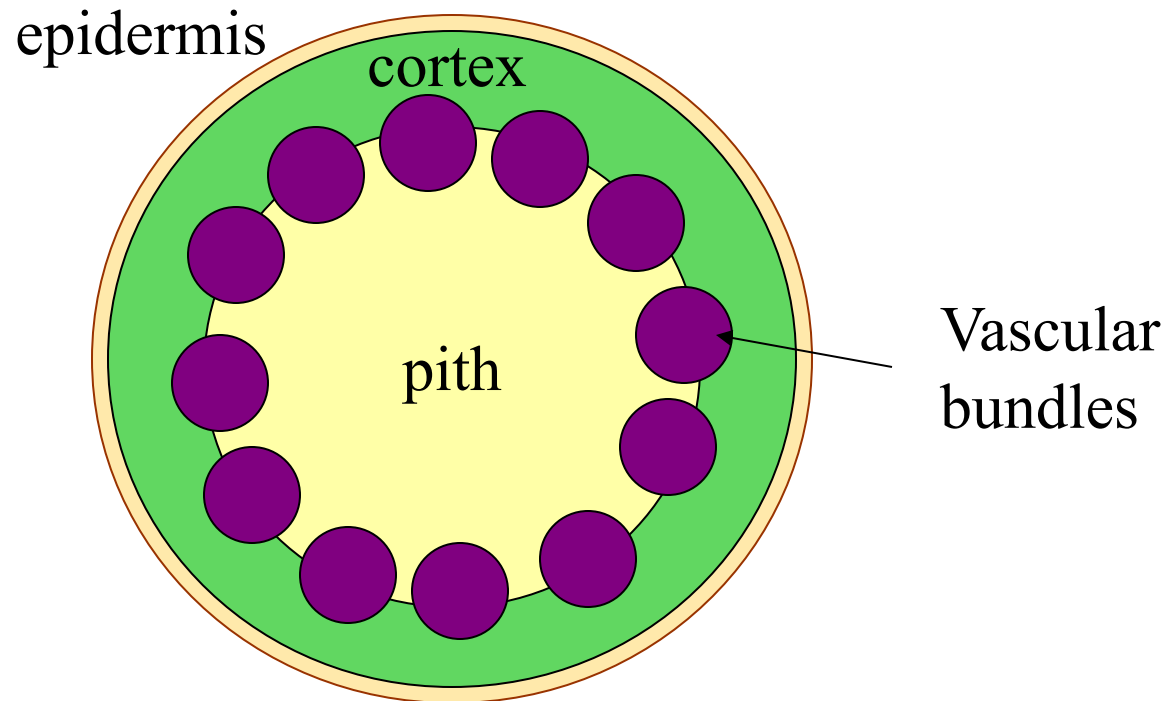
STEMS

- Above-ground organs (usually)
- Support leaves and fruits
- Conduct water and sugars throughout plant (xylem and phloem)

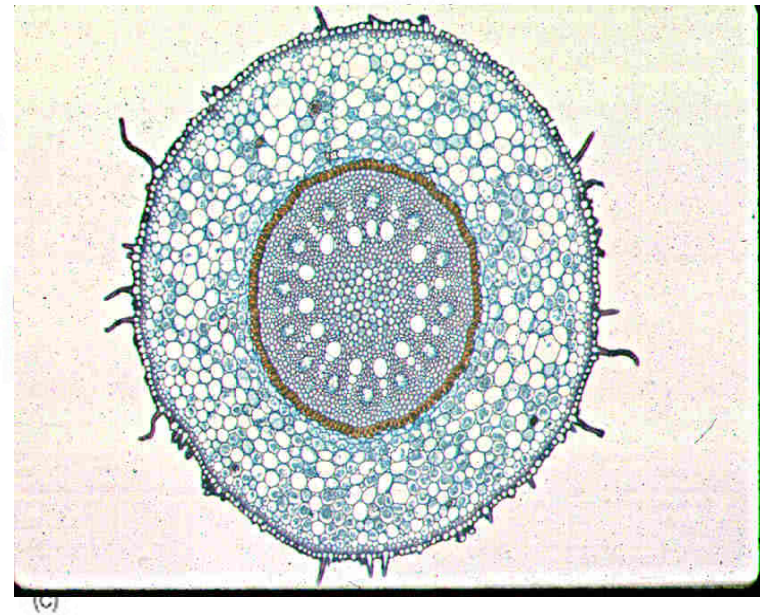
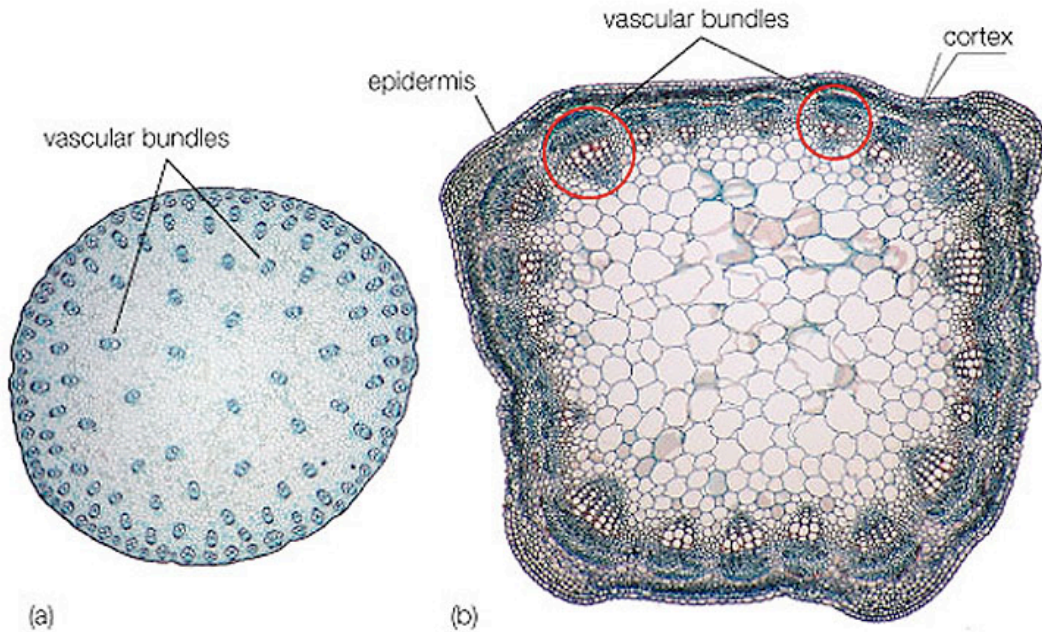


Stem anatomy

- Dermal, ground and vascular tissues...



Types of Stems



Monocot stem

Dicot stem

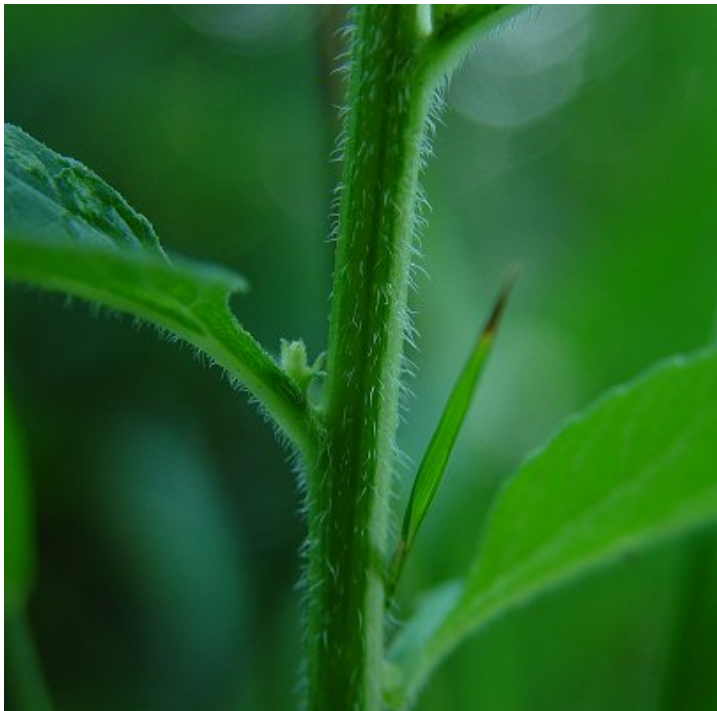
Root

Types of stems

- Herbaceous

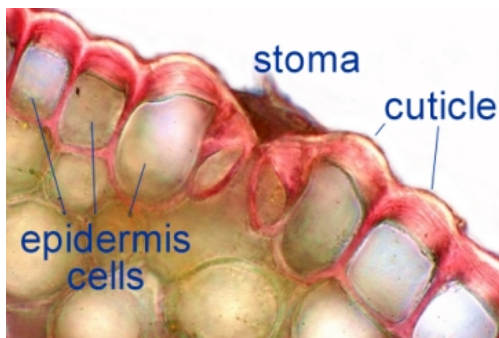
vs.

Woody stems



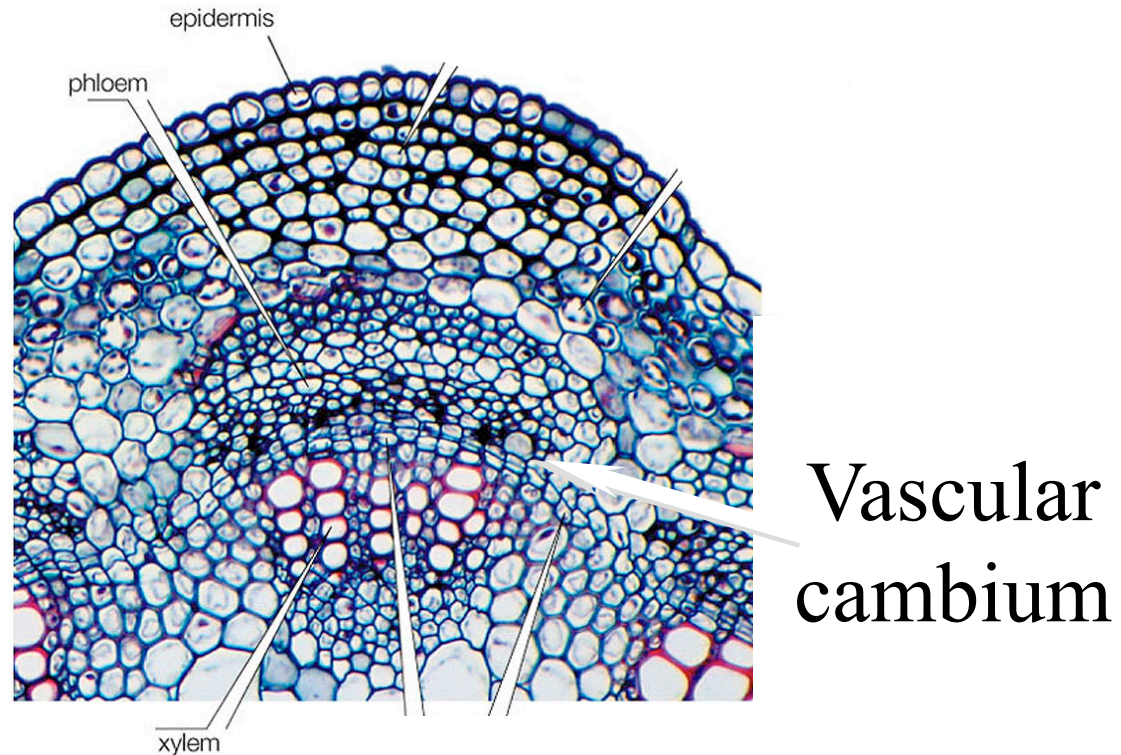
Tissues of stems

- **Epidermis** (Dermal tissue type)
- Provides protection
- Has **cuticle** (wax) prevents water loss
- Trichomes (hairs) for protection, to release scents, oils, etc.



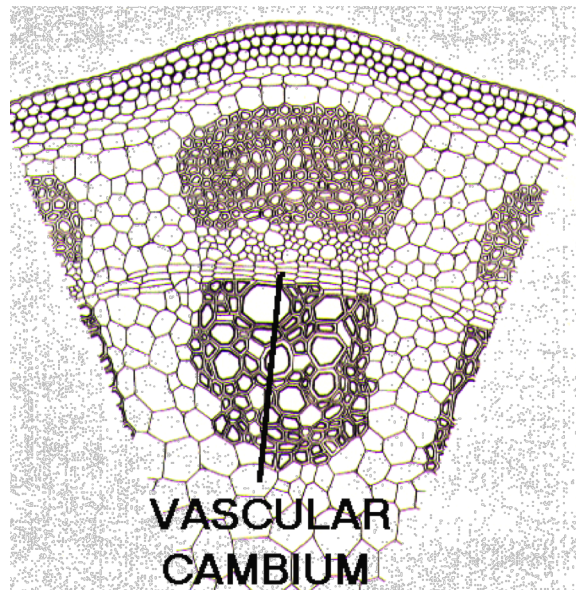
Stem Vascular tissue

- **Vascular bundles** – composed of both xylem and phloem
- **Xylem**
 - Conducts water
 - Support
- **Phloem**
 - Conducts food
 - Support



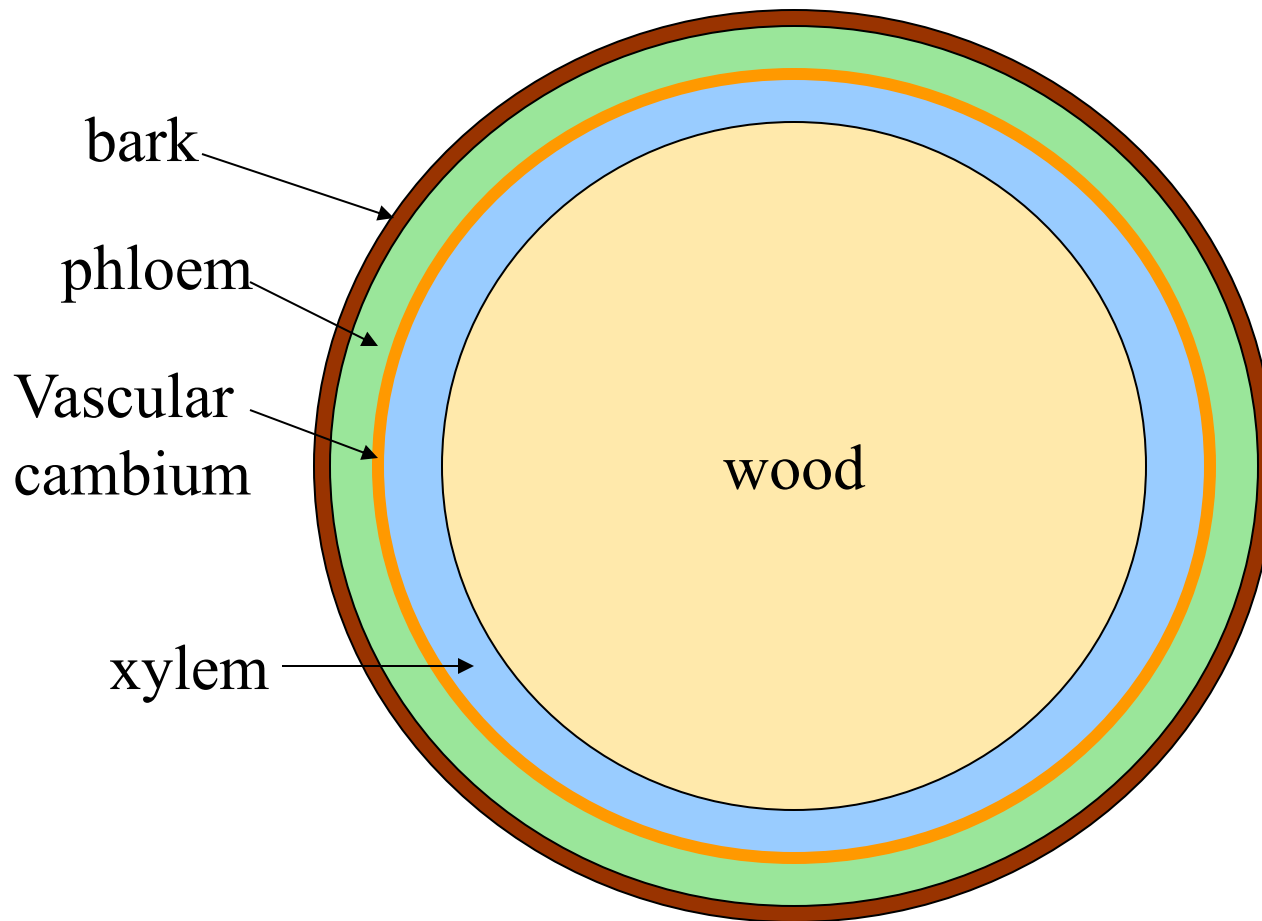
Vascular cambium

- Occurs in woody stems
- **Vascular cambium** located in the middle of the vascular bundle, between xylem and phloem



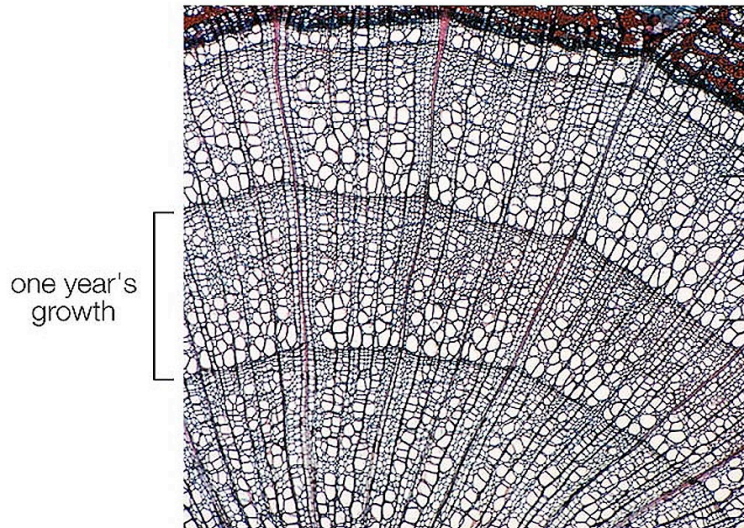
Vascular tissue: Trees

- Vascular tissue is located on the outer layers of the tree.



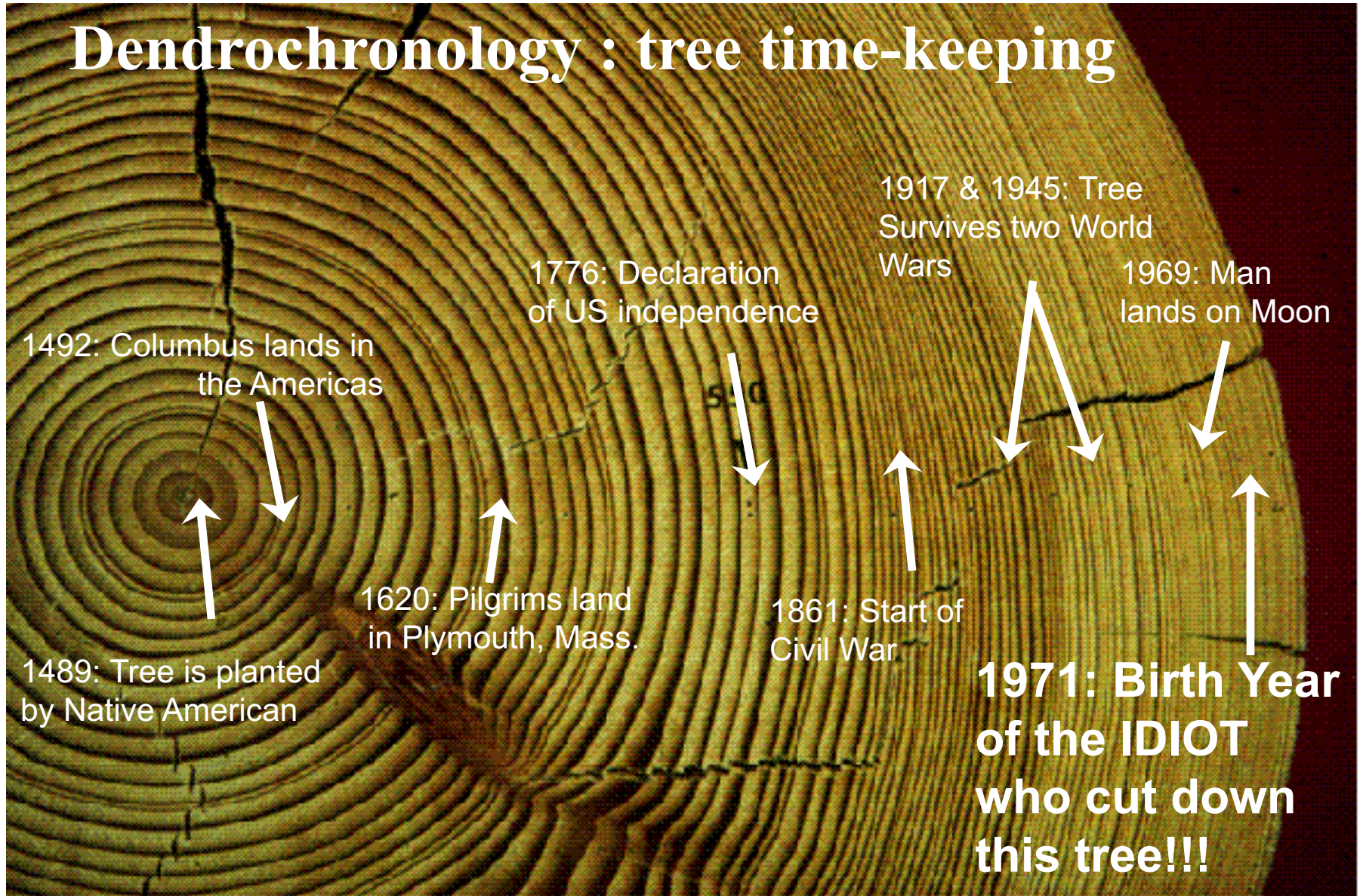
Vascular tissue forms rings in trees

- **Annual rings:** xylem formed by the vascular cambium during one growing season
- One ring = one year



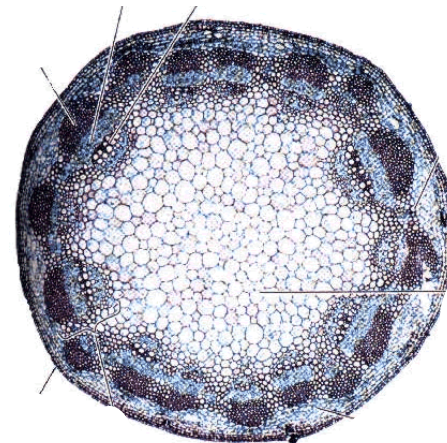
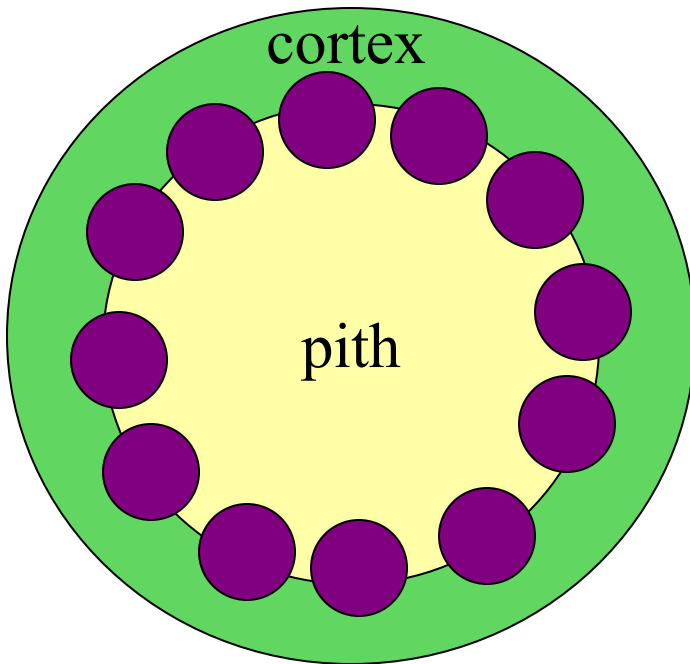
History of the tree: annual rings

Dendrochronology : tree time-keeping



Ground tissue: Cortex & pith

- Stores food (e.g. potato)
- Site of Photosynthesis (when green)
- Support cells

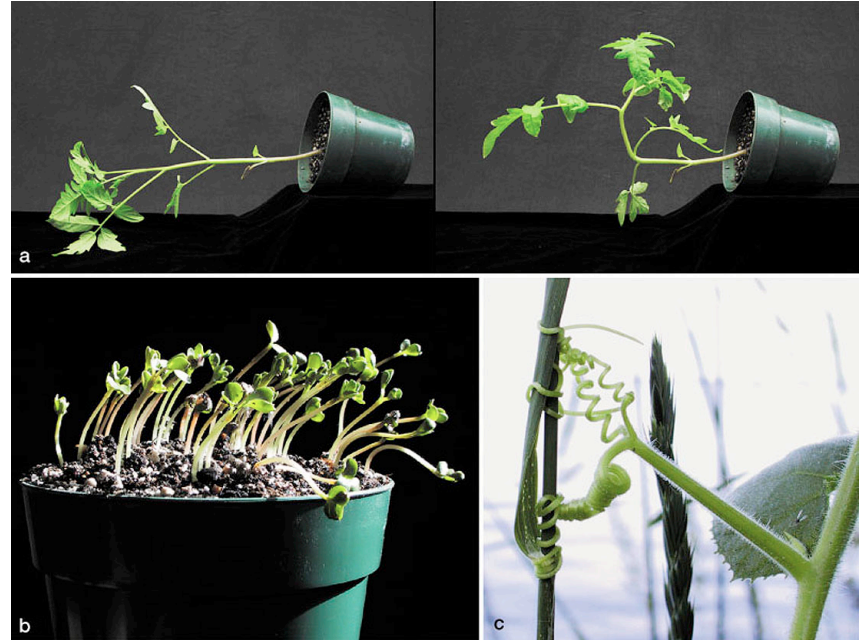


Plant Hormones

- Chemical compounds produced by plants
- Effective at very low concentrations
- Five major hormone groups are:
 1. Auxins
 2. Gibberellins
 3. Cytokinins
 4. Abscisic Acid
 5. Ethylene

1. AUXINS

- Promote cell growth
- Involved in gravitropism



and phototropism

- Control fruit development



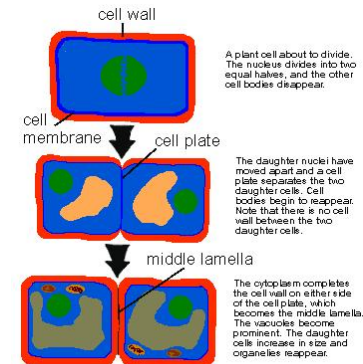
2. Gibberellins

- Promote stem elongation



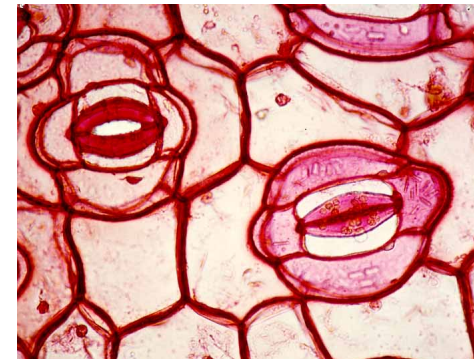
3. Cytokinins

- Promote cell division and organ differentiation



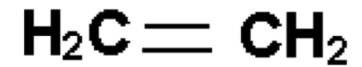
4. Abscisic Acid

- Promotes seed dormancy
- Causes stomata closing



5. ETHYLENE

- Gaseous hormone,
very simple formula (C_2H_4)
- Ethylene promotes
fruit ripening!



Ethylene



Air

Ethylene